The 2018 Mw 6.8 Zakynthos, Greece, earthquake – strike-slip and thrust faulting in shallow subduction

Efthimios Sokos¹, František Gallovič², Christos P. Evangelidis³, Anna Serpetsidaki¹, Vladimír Plicka³, Jan Kostelecký⁴, and Jiří Zahradník²

¹University of Patras, Geology, Seismology Laboratory, Geology, Patras, Greece (esokos@upatras.gr)
²Charles University, Faculty of Mathematics and Physics, V Holešovičkách 2, 180 00, Prague 8, Prague, Czech Republic
³National Observatory of Athens, Institute of Geodynamics, Lofos Nimfon Athens, 11810 Greece
⁴Faculty of Mining and Geology, Technical University Ostrava, Czech Republic

On October 25, 2018, at 22:54 UTC, an Mw 6.8 earthquake occurred southwest of Zakynthos island in the Ionian Sea. This is an area with different styles of faulting and the locus of strong events thus ideal for fault interaction studies. The 2018 Zakynthos earthquake was recorded by broadband and strong-motion networks and provides an opportunity to resolve such faulting complexity. We used waveform inversion and backprojection of strong motion data, partly verified by co-seismic GNSS data, too. The aftershock sequence was relocated, and the moment tensors of the strongest events were evaluated. Stress inversion shows that the region is under sub-horizontal southwest-northeast compression, enabling mixed thrust- and strike-slip faulting. Based on detailed waveform inversion studies, we conclude that the 2018 mainshock consisted of two fault segments: a low-dip thrust, and a dominant, moderate-dip, right-lateral strike slip, both in the crust. This model explains the observed large negative CLVD component of the mainshock. Slip vectors of both ruptured segments, oriented to SW, are consistent with plate motion in the area. The sequence can be explained in terms of trench-orthogonal fractures in the subducting plate and reactivated faults in the upper plate. The 2018 event, and an Mw 6.6 event of 1997, occurred near three localized swarms of 2016 and 2017. Future numerical models of the slab deformation and ocean-bottom seismometer observations may illuminate possible relations between earthquakes, swarms and fluid paths in the region.